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Cost benefit analysis for the United States Navy's closed circuit television system

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Monterey, California. Naval Postgraduate School

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NAVAL POSTGRADUATE SCHOOL
Monterey, California

THESIS

COST BENEFIT ANALYSIS FOR THE UNITED STATES NAVY'S CLOSED CIRCUIT TELEVISION SYSTEM

by

Thomas A. Martucci III

December 2000

Thesis Co-Advisors: William Gates
                                                 Cary Simon

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REPORT DOCUMENTATION PAGE

Form Approved OMB No. 0704-0188

1. AGENCY USE ONLY *(Leave blank)*	2. REPORT DATE December 2000	3. REPORT TYPE AND DATES COVERED Master's Thesis

4. TITLE AND SUBTITLE: Cost Benefit Analysis For The United States Navy's Closed Circuit Television System	5. FUNDING NUMBERS
6. AUTHOR(S) Martucci, Thomas A. III	

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Naval Postgraduate School Monterey, CA 93943-5000	8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES) Bureau of Naval Personnel (Pers -OOR), Millington TN 38055	10. SPONSORING/ MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

The views expressed in this thesis are those of the author and do not reflect the official policy or position of the Department of Defense or the U.S. Government.

12a. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution is unlimited.	12b. DISTRIBUTION CODE

13. ABSTRACT *(maximum 200 words)*

    This thesis provides insight and a possible solution for improving the United States Navy's Closed Circuit Television (CCTV) System and training tape system. The Department of Defense (DoD), and specifically, the United States Navy, can incorporate commercial technologies that would improve the quality of life of its members, the quality of its shipboard training, and reduce the cost of providing CCTV support to deployed personnel.

    The Office of Management and Budget (OMB) circulars A-76 and A-94 were used as guidelines to study potential cost savings and reduction measures. Data collection provided in this study consisted of internet and electronic queries, personal interviews, and telephone correspondences.

    Results indicated that consolidating DoD media commands and converting to a Digital Video Disc (DVD) technology could reduce overall costs to the Navy and improve product quality. The Navy should validate these exploratory findings and consider implementing the following: consolidate television weekly (TW) and duplication facility (DUPFAC) services, replace existing 8mm players with commercial DVD players, and acquire future recorded media (movies and training films) on DVD.

14. SUBJECT TERMS Cost Benefit Analysis, DVD Equipment Acquisition, Purchase versus Repair Comparison	15. NUMBER OF PAGES
	16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT Unclassified	18. SECURITY CLASSIFICATION OF THIS PAGE Unclassified	19. SECURITY CLASSIFICATION OF ABSTRACT Unclassified	20. LIMITATION OF ABSTRACT UL

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COST BENEFIT ANALYSIS FOR THE UNITED STATES NAVY'S CLOSED CIRCUIT TELEVISION SYSTEM

Thomas A. Martucci III
Lieutenant, United States Navy
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Submitted in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE IN MANAGEMENT

from the

NAVAL POSTGRADUATE SCHOOL
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ABSTRACT

This thesis provides insight and a possible solution for improving the United States Navy's Closed Circuit Television (CCTV) System and training tape system. The Department of Defense (DoD), and specifically, the United States Navy, can incorporate commercial technologies that would improve the quality of life of its members, the quality of its shipboard training, and reduce the cost of providing CCTV support to deployed personnel.

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ACRONYMS

AFIS	American Forces Information Service
AFN	Armed Forces Network
AFRTS	Armed Forces Radio and Television Service
AGC	Automatic Gain Control
ASAT	Automated Systems Approach to Training
ASD-PA	Assistant Secretary of Defense for Public Affairs
APS	Analog Protection System
AV	Audio Visual
BUPERS	Bureau of Naval Personnel
CASI	Cinema At Sea Initiative
CCTV	Closed Circuit Television
CD	Compact Disc
CDV	Compact Disc Video
CNO	Chief of Naval Operations
COTS	Commercial-Off the Shelf
CPPM	Content Protection for Prerecorded Media
CPRM	Content Protection for Recordable Media
CPSA	Content Protection System Architecture
CPTWG	Copy Protection Technical Working Group
CSS	Content Scrambling System
DAVIS	Defense Automated Visual Information System

DCPS	Digital Copy Protection System
DIS	Defense Information Service
DITIS	Defense Instructional Technology Information System
DIVX	Digital Video Express, L. P.
DoD	Department of Defense
DLT	Digital Linear Tape
DTCP	Digital Transmission Content Protection
DTS	Direct to Sailor
DUPFAC	Duplication Facility
DVD	Digital Video Disc
DVIC	Defense Visual Information Center
DX	Direct Exchange
FEDEX	Federal Express
FPO	Fleet Post Office
FROST	First Run Overseas Theater
GAO	Government Accounting Office
Hi8	High-Band 8mm
IFB	Invitation For Bid
ICN	Internal Control Number
IMI	Interactive Multimedia Instruction
MEO	Most Efficient Organization
MMC	Multimedia Contracts

MPEG	Moving Pictures Experts Group
MSC	Military Sealift Command
MWR	Moral Welfare and Recreation
NARA	National Archives and Records Administration
NETPDTC	Naval Education & Training Professional Development & Technology Center
NSHS	Naval School of Health Sciences
NMPS	Navy Motion Picture Service
NOAA	National Oceanographic and Atmospheric Association
NTSC	National Television System Committee
OMB	Office of Management and Budget
OTT	Office of Training Technology
PAL	Phase Alternate Line
PC	Personal Computer
PIN	Production Number
PL	Public Law
PMS	Preventative Maintenance System
QOL	Quality of Life
RFP	Request For Proposal
SCMS	Serial Copy Generation Management System
SPIDER	Seamless Product Information, Data Exchange and Repository
S-VHS	Super Video Home System

TPD	Television Programming Daily
TW	Television Weekly
USCG	United States Coast Guard
VHS	Video Home System

ACKNOWLEDGEMENT

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DEDICATION

To the crew of the USS COLE (DDG 67) and our fallen shipmates...

ENS Andrew Triplett, Macon, Mississippi

ETC Richard Costelow, Morrisville, Pa.

EN2 Marc Ian Nieto, Fond Du Lac, Wisconsin

EW2 Kevin Shawn Rux, Portland, North Dakota

OS2 Timothy Lamont Saunders, Ringgold, Virginia

EW3 Ronald Scott Owens, Vero Beach, Florida

HT3 Kenneth Eugene Clodfelter, Mechanicsville, Virginia

MS3 Ronchester Mananga Santiago, Kingsville, Texas

ENFN Joshua Langdon Parlett, Churchville, Maryland

ITSN Timothy Lee Gauna, Rice, Texas

MSSN Lakeina Monique Francis, Woodleaf, North Carolina

SMSN Recruit Cherone Louis Gunn, Rex, Georgia

FN Gary Graham Swenchonis, Jr., Rockport, Texas

SN James Rodrick McDaniels, Norfolk, Virginia

FA Patrick Howard Roy, Keedysville, Maryland

SA Craig Bryan Wibberley, Williamsport, Maryland

SR Lakiba Nicole Palmer, San Diego, California

As American servicemen and women, they served with honor and pride. The October 12, 2000 attack will not be forgotten.

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I. INTRODUCTION

A. BACKGROUND

The Navy spends approximately $325,000 each year to provide and maintain its closed circuit television system (CCTV).[1] Tight economic resources, outsourcing trends, and new technologies portend possible changes in this low profile but important area. New technology, e.g. digital videodisc systems, may enable the Navy to enhance or replace the existing CCTV system. Several questions are addressed in this thesis. What will the Navy choose for its future CCTV system? Is the current system cost efficient? Should the Navy seek efficiencies, or major changes to its current CCTV system, including consolidating duplicate functions? This study describes currently available options for providing CCTV and compares various costs and benefits. It explores efficiency (following Office of Management and Budget circulars A-76 and A-94) and privatization options. The Government Performance & Results Act, National Performance Review & Reinventing Government, and the Revolution in Business Affairs provide foundations for the importance of identifying intended results and generating cost savings to pay for fleet modernization.

This study addresses:

1. Potential cost reductions for administering the existing closed circuit television system.

---

[1] This figure is a best estimate. After numerous inquiries (including traveling to Naval Media Center Headquarters in Washington DC), Naval Media Center declined to provide actual accounting data.

2. Outsourcing, privatizing, or consolidating the distribution process for recorded medium. OMB circular A-76 guidelines apply. Additionally, A-76 provides guidelines for the commercialization of audiovisual products and services described in Table 1.

Table 1.   Examples Of Commercial Activities

Audiovisual Products and Services
Photography (still, movie, aerial, etc.)
Photographic processing (developing, printing, enlarging, etc.)
Film and videotape production (script writing, direction, animation, editing, acting, etc.)
Microfilming and other microforms
Art and graphics services
Distribution of audiovisual materials
Reproduction and duplication of audiovisual products
Audiovisual facility management and operation
Maintenance of audiovisual equipment

From: OMB Circular No. A-76 (Attachment A)

3. Converting the existing system to a Digital Video Disc (DVD) system (e.g. DVD disc and player acquisition). OMB circular A-94 guidelines apply.

4. Improving quality of training by replacing training films with DVDs. It appears a reasonable hypothesis that enhanced television (including shipboard training and entertainment) could positively impact both retention and training.

B.   OBJECTIVES

This study examines the Navy's Closed Circuit Television System and explores the costs and benefits of improving the system or replacing it with a Digital Videodisc (DVD) system. The study provides additional insight and recommendations for improving the CCTV enterprise. The Navy's Closed Circuit Television System is a legacy system and process that might be better served by introducing new technology. The study is exploratory because introducing the DVD system, including logistical support, requires extensive analysis beyond the scope of this paper. The study is also exploratory because essential accounting data was not provided. The option of improving the existing system considers the Most Efficient Organization (MEO) concept, including consolidating the existing program structure. Inherently Governmental functions need to be addressed for future analysis. Government employees so intimately relate these functions to the public interest as to mandate their performance (OMB A-76, p. 53).

C.   RESEARCH QUESTIONS

1. What are the costs and benefits (economic, maintenance, system availability, and quality of life) of improving or replacing the Navy's closed circuit television system?

2. What are the comparative costs, benefits and savings associated with converting the Navy's closed circuit television system to a digital videodisc system?

3. What are the comparative costs, benefits, and savings associated with converting the Navy's training library to a digital videodisc system?

D. SCOPE AND LIMITATIONS

The scope of this study includes the following:

1. Describing the Navy's existing closed circuit television system, e.g., fleet role, physical components, complexity, and approximate cost.

2. Describing a comparable replacement digital videodisc system.

3. Reviewing current distribution procedures and potential improvements using OMB circulars A-76 and A-94 as guidance, e.g., Most Efficient Organization considerations.

Several military commands and commercial firms were contacted and/or interviewed to obtain relevant data. Although commercial costs were sought and obtained, exact financial data from private firms were not available due to proprietary concerns. Other limitations of this study include:

1. Maintenance hours required for the existing Navy closed circuit television system were not provided and are therefore approximated.

2. The specific number of 8 mm players was not provided and are therefore approximated, e.g., in the fleet and direct exchange storage warehouse.

3. Specific product costs for the Navy were not provided and are therefore approximated, e.g., commercial licensing and distribution fees of recorded medium prior to public consumption.

4. Replacement costs of new technology, specifically DVD players, are estimated without a request for proposal (RFP) or invitation for bid (IFB).

Additionally, factors that were not used include the cost of the numerous transfers of videotapes between ships and the production costs of the recorded medium provided by the Naval Media Center's duplicating facilities (DUPFACs) for the fleet. Cost estimation techniques were used to reduce potential errors in cost calculations. Survey results were not required from user commands.

E. METHODOLOGY AND DATA COLLECTION PROCESS

A literature review was conducted using relevant books and journal articles, including internet data sources to understand and explain the Navy's Closed Circuit Television System. Eight semi-structured interviews were conducted with personnel involved in the Navy's CCTV system. Additionally, 12 private sector personnel were interviewed for comparative purposes. A Most Efficient Organization (MEO) approach was also explored using the applicable guidelines in the following documents:

1. OMB circular A-76: "Performance of Commercial Activities"

2. OMB circular A-94: "Guidelines and Discount Rates for Benefit Cost Analysis of Federal Programs"

As part of the DVD alternative, private sector practices were considered. The study analyzed costs and benefits of the Navy's closed circuit television system compared to an alternative DVD system to identify potential savings and program improvements, and explored the privatization option. Best available cost data is compared and analyzed to project potential savings.

F. ORGANIZATION OF STUDY

Chapter II describes the Navy's existing closed circuit television system and Department of Defense videotape sources, including the Naval Motion Picture Service, Armed Forces Network, and Joint Visual Information Services. Chapter III discusses the specifications of the Digital Video Disc and an alternative digital videodisc system. Chapter IV presents and analyzes the data collected. Chapter V summarizes the findings of the thesis and makes recommendations on future courses of action.

II. SYSTEM PARAMETERS AND VIDEO SOURCES

This chapter describes the existing Closed Circuit Television (CCTV) systems, the various videotape providers, and the video programming used in the fleet. The American Forces Information Service (AFIS) is responsible for all audio and video programming provided to the United States Military and other Department of Defense (DoD) supported entities. Separate commands provide specific mission essential products and services to the men and women of the American armed forces. Several commands and their products will be discussed.
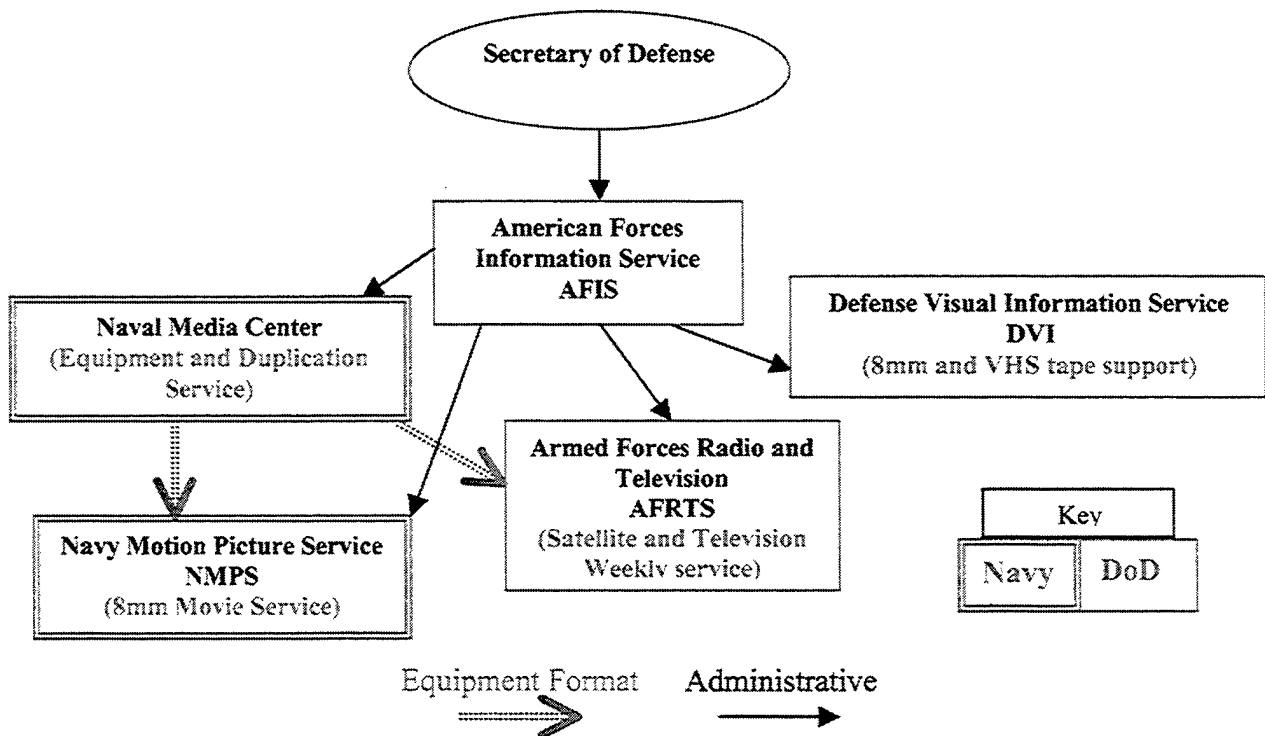
Figure 1.   Naval Video Source Commands

A. EXISTING CLOSED CIRCUIT TELEVISION SYSTEM
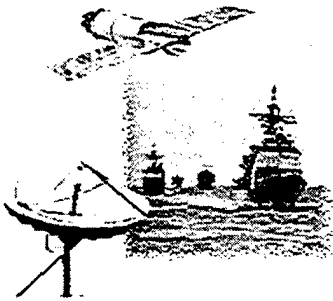
The existing CCTV system depends on ship type. Naval Media Center has authorized four systems (SITE 200, 300, 400 and 501) for fleet use. Table 2 provides an estimated count, by system, for the total number of 8mm players used throughout the fleet. All systems have a VHS player. The SITE 200 system is deployed on submarines only. This system has play back capability only. The SITE 300 system has limited production capabilities and is deployed on all major small combatants. The SITE 400 system is a SITE 300 system with an expanded production capability used to support limited studio productions. It is deployed on large amphibious ships. The SITE 501 system is deployed on all aircraft carriers and incorporates equipment to support a full production studio. Equipment layout for the SITE 300 and SITE 400 systems are provided in Appendix A and B respectively.

Table 2.   Estimated Number of 8mm Players In The Fleet

Site SYSTEM	200 AN/ BXQ-5	300 AN/UXQ-18	400 AN/UXQ-19	501 AN/UXQ-66
Ship Type	SSN, SSBN	FFG, DD, DDG, CG, LPD, AO, AOE	LSD, LHA, LHD, MPH	CV, CVN
Systems in Fleet	49	138	35	11
8 mm Players	2	3	4	4
Total 8mm Players	98	414	140	44

From: Naval Media Center, July 2000

Not all ships are configured as indicated in Table 2. Some commands acquired additional DTS receivers instead of the allocated 8 mm players. The system used on very small craft (i.e. MH, MHC, PC) will not be discussed in this study. The Direct To Sailor (DTS) satellite system (SITE 300, 400 and 501) will be discussed separately.

B.   AMERICAN FORCES INFORMATION SERVICE

American Forces Information Service (AFIS) is the principal internal information organization within DoD. AFIS works directly for the Assistant Secretary of Defense for Public Affairs (ASD-PA). All commands fall under the administrative control of AFIS.
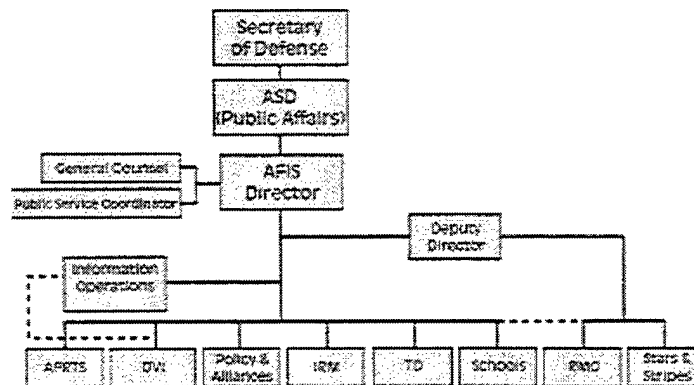
Figure 2.   AFIS Organization
From: American Forces Information Service Web Page, October 2000

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C. NAVAL MEDIA CENTER

The Naval Media Center is responsible for overseeing the fleet's CCTV system. Naval Media Center predetermines the product format used by the Armed Forces Radio and Television Service (AFRTS) and Naval Motion Picture Service (NMPS) as well as the audiovisual format used in the fleet.

1. Fleet Support Detachments

The Fleet Support Detachment (FSD) provides tailored training; directed at the specific SITE system onboard, direct exchange of defective equipment and maintenance assistance, and administrative guidance in the operating the CCTV system. Presently, there are six operational Fleet Support Detachments (FSDs), including: San Diego California, Norfolk Virginia, Pearl Harbor Hawaii, Yokosuka Japan, Sigonella Italy, and Bahrain. Additionally, FSD Norfolk and San Diego are responsible for administering the Atlantic and Pacific Fleet Television Weekly Units (TW) distribution. Armed Forces Radio and Television Service (AFRTS) provides the TWs to the deployed units.

2. Fleet Duplication Facilities

Forward deployed units also receive special programming events from duplication facilities (DUPFAC) for high value programming on Hi-8 (e.g. Super Bowl and World Series). DUPFAC locations are in Sigonella, Bahrain and Yokosuka.

D.   NAVY MOTION PICTURE SERVICE

The Navy Motion Picture Service (NMPS) is funded by Moral Welfare and Recreation (MWR) fund (PERS-650). NMPS provides movie service to 785 activities (Navy, Marines, Coast Guard, Military Sealift Command, National Oceanographic and Atmospheric Association, the State Department, and U.S. Embassy sites). Programs include the 8mm videotape program afloat and the 8mm and 35 mm videotape program ashore.

1.   The 8mm Videotape Program Afloat

Seven hundred fifty five clients receive 16 8mm videotapes every month. NMPS distributes movies 30-60 days prior to public release. There are over 425,000 8mm videotapes in active circulation. The average library size per command is 575 tapes. Units are responsible for maintaining the inventory provided by NMPS. Movies are provided for a three-year term and must be returned to NMPS by the expiration date specified in the studio agreement and listed on the data label of every tape. Beginning with fiscal year 2001, the lease term will be extended to four years. Estimated annual Fleet program usage is over one million hours.

NMPS maintains an inventory of nine copies of each movie. Approximately 10 percent of all videotapes are spot-checked prior to distribution.

a. Cinema At Sea Initiative (CASI)

CASI returns large screen movie presentation to the fleet by using a portable screen, sound, and 8mm tape movies. There are approximately 100 ships equipped with CASI systems. The current budget (FY-00) projects distributing 120 additional CASI systems to the fleet (cost of $1.3M). For smaller ships that cannot accommodate a large-screen CASI equipment package, a flat Screen TV is provided. The flat screen TV is an initiative to provide the latest product on the video market.

2.   The 8mm and 35mmVideotape Program Ashore

The 8mm video theater concept incorporates CASI-style equipment, including a large screen and a video projector with a surround sound system, in a small theater environment furnished with theater-style seating. Admission is free. Estimated attendance in FY-99 was 2M patrons.

First Run Overseas Theater (FROST) provides selected new movie releases to overseas base theaters within two weeks of commercial US premieres. Estimated attendance in FY-99 was 2.6M patrons. The only drive-in theater on a military base is in Rota Spain.

E.   ARMED FORCES RADIO AND TELEVISON SERVICE

Since 1942, when the War Department formally created Armed Forces Radio, thousands in the entertainment industry and the Department of Defense have been associated with the Armed Forces Radio and Television Service (AFRTS). Located in Riverside California, on March ARB, they are the sole providers of satellite television service to the United States Armed Forces. All programming originates at the Riverside facility. AFRTS provides the satellite feed for the Armed Forces Network, AFRTS radio, and Direct to Sailor programming as well as 8mm tapes for fleet distribution of Television Weekly (TW) units for the sixteen circuits (see Appendix C). A TW Circuit consists of three or four deployed ships that are located in the same geographic area.

1. Armed Forces Network

The Armed Forces Network (AFN) covers four regions (Atlantic, Korea, Pacific and Europe). Each region receives the satellite feed from AFRTS, adds local command infomercials and public service announcements, and rebroadcasts over a local satellite (see Appendix D for programming schedule). Figure 2 illustrates the AFRTS satellite network.

AFRTS SATNET NETWORK DIAGRAM

| GE 1 103 DEG WEST VP, 4.100 GHz | INTELSAT 707 359 DEG EAST RHCP, 4.175 GHz | EUTELSAT Ku 10 DEG EAST VP, 11.16933 GHz | INTELSAT 702 177 DEG EAST LHCP, 4.177 GHz |

BREWSTER, WA. POR UPLINK

AFRTS-BC

AMERICAS DOWNLINK SITES

WHITINSVILLE, MA. AOR UPLINK

AOR DOWNLINK SITES

EUTELSAT DOWNLINK SITES

FIBER

AFN FRANKFURT

EUSINGEN, GE. UPLINK

POR DOWNLINK SITES

Americas PowerVu Setup	Atlantic (AOR) PowerVu Setup	Eutelsat PowerVu Setup	Pacific (POR) PowerVu Setup
Band: C/L-Band Freq. L/C Band Freq: 1050.00 (MHz) FEC Rate: 3/4 Symbol Rate: 28.0000 (MS/s) Network ID: 1 C-Band LO: 5.150 (GHz)	Band: C/L-Band Freq. L/C Band Freq: 975.00 (MHz) FEC Rate: 3/4 Symbol Rate: 28.0000 (MS/s) Network ID: 3 C-Band LO: 5.150 (GHz)	Band: Low Ku/L-Band Freq. L/C Band Freq.: (1169.25 or 1419.25 MHz) FEC Rate: 3/4 Symbol Rate 17.1800 (MS/s) Network ID: 4 Ku/Lo Band LO: (10.00 or 9.750 GHz)	Band: C/L-Band Freq. L/C Band Freq.: 973.00 (MHz) FEC Rate: 3/4 Symbol Rate: 28.0000 (MS/s) Network ID: 2 C-Band LO: 5.150 (GHz)

Figure 3.   AFRTS Satellite Coverage
From: American Forces Radio and Television Service, July 2000

Local commands are not allowed to edit programming, but may black out specific shows due to local country sensitivities. AFRTS Riverside occasionally interrupts programming for current significant events. AFN provides each location with four channels of programming.

a. NewSport channel

NewSport channel provides 24-hour coverage of news and sports events. After the 2000 Summer Olympic games, there will be separate news and sports channels.

b. Spectrum

Spectrum is AFN's movie channel. The channel is similar to HBO or Showtime movie service.

c. Regional Television Programming (Atlantic, Pacific, Korea)

AFN features the best of American television including top shows from ABC, CBS, CNN, ESPN, FOX, NBC, and PBS.

2. Direct To Sailor

Direct to Sailor (DTS) programming includes two video channels of the AFN broadcast (AFN DTS Atlantic or Pacific and NewSport Channel), three Audio Channels (2 Stereo Music Services, 1 Mono News & Sports Service), one Data Channel (128 kbps text service-Navy News, Newswires, Times Fax, Stripes Lite, Early Bird) and one Program Guide Channel. One of three INMARSAT (International Maritime Satellite) satellites provide deployed fleet units with the DTS and AFRTS radio service (Indian Ocean, Pacific Ocean, and Atlantic Ocean Regions). Figure 3 shows the three DTS satellite coverage regions.

Satellite Network Map (outside Europe)
DTS NETWORK CONFIGURATION

GE-1
(Domestic Relay
Connectivity only)

INTELSAT 803
338.5 DEG EAST
AOR, Left Hand
Circular Polarized
4.142 (GHz)

INTELSAT 804
64.1 DEG EAST
IOR, Left Hand
Circular Polarized
4.0800 (GHz)

INTELSAT 701
180 DEG EAST
POR, Left Hand
Circular Polarized
4.1730 (GHz)

FIBER

AOR RELAY
HOLMDEL N.J.

IOR RELAY
GOONHILLY, ENGLAND

POR UPLINK
STEELE VALLEY
CALIFORNIA

AFRTS-BC

Atlantic Ocean Region (AOR)

PowerVu Setup
Band: C/L-Band Freq.
L/C Band Freq.: 1008.00 (MHz)
FEC Rate: 2/3
Symbol Rate: 3.6800 (MS/s)
Network ID: 6
C Band LO: 5.150 (GHZ)

Indian Ocean Region (IOR)

PowerVu Setup
Band: C/L-Band Freq.
L/C Band Freq.: 1070.00 (MHz)
FEC Rate: 2/3
Symbol Rate: 3.6800 (MS/s)
Network ID: 7
C Band LO: 5.150 (GHz)

PacificOcean Region (POR)

PowerVu Setup
Band: C/L-Band Freq.
L/C Band Freq.: 976.50 (MHz)
FEC Rate 2/3
Symbol Rate: 3.6800 (MS/s)
Network ID: 5
C Band LO: 5.150 (GHz)

Figure 4.   AFRTS DTS Satellite Coverage
From: American Forces Radio and Television Service, July 2000

DTS News is a unique news program designed specifically for deployed sailors. DTS News turns ordinary message traffic and command information into news that sailors at sea can use and enjoy. DTS News is also a shipboard Commander's opportunity to receive worldwide, well-deserved publicity for their ship and crew, via the DTS satellite network.   DTS News is a two-minute daily report, inserted into regularly scheduled DTS programming at various times of the day, permitting maximum exposure of command information.

Potential improvement capabilities have been incorporated into the DTS system to provide the ability to add more services in the future, including daily, to the minute reports; Navy CI spots and promotions; and programming aimed at deployed sailors.

3. Television Weekly Units

Television Weekly (TW) Units are recorded (on 8mm tapes) bi-weekly, providing various programming from the major US television networks (ABC, CBS, NBC, FOX, PBS). The TW masters (recorded on super VHS tapes) are sent to a private firm (Media Copy) for duplication and distribution. 24 hours of programming per week are provided (see Appendix E).
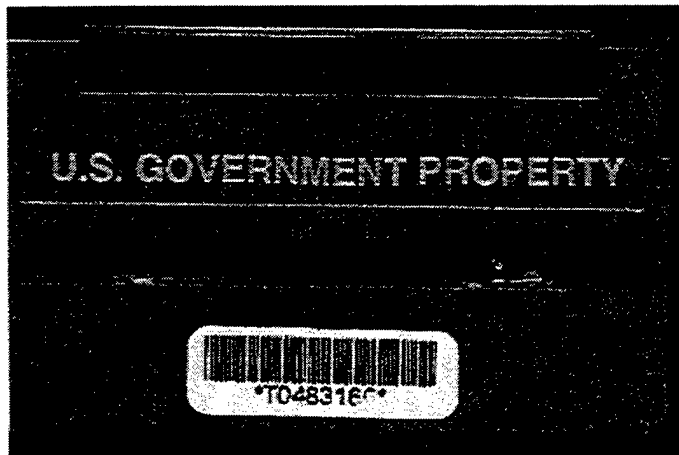
Figure 5.   8mm –TW Tape

Naval Media Center Fleet Support Detachments Virginia and San Diego are responsible for administrating 16 TW circuits. A TW Circuit includes three or four deployed ships that are located in the same geographic area. The lead ship is sent two weeks of material (24 tapes – 48 hours of programming) in a durable shipping container.

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The lead ship forwards this container to the next ship on the circuit when it receives a new container. The last ship on the circuit returns the container to AFRTS for destruction.

F. DEFENSE VISUAL INFORMATION SERVICE

Defense Visual Information Service is the controlling organization for the Joint Visual Information Services Distribution Activity (JVISDA), located at the Tobyhanna Army Depot in Northeast Pennsylvania. DVI distributes DoD audiovisual productions in accordance with the master distribution plan for each new or restocked production. Another subordinate command is the Defense Automated Visual Information System/Defense Instructional Technology Information System (DAVIS/DITIS). DAVIS provides information about audiovisual (AV) productions and interactive multimedia instruction (IMI) products to support training, command information and operational missions. The site contains searchable listings and descriptions of thousands of DoD audiovisual productions and interactive media products. AV productions and IMI products include videotapes, films, and multimedia products that were produced by or for DoD.

The Department of Defense also maintains a state-of-the-art storage, research, and distribution facility for significant motion picture stock footage, video, still imagery and mixed media visual information products depicting DoD, its heritage and its activities.

III.   ALTERNATIVE DIGITAL VIDEODISC SYSTEM

Chapter III discusses the specifications of the Digital Video Disc (DVD) and the proposed DVD system. The information presented is intended to provide general background information to the reader, but not to be a technical reference for DVD discs and players. References located at the end of the thesis can provide the reader with specific points of contact for industry specifications.

A.   DIGITAL VIDEO DISC SPECIFICS

Are Digital Video Discs (DVDs) the standard of the new millennium? DVDs are the most successful packaged media product launched in history! According to the Consumer Electronics Manufacturers Association, more than 10 million DVD-Video players have shipped to dealers, with Video Scan reporting more than 11 million DVD software units sold to consumers since the format launch in 1996. In addition, analysts estimate that the installed base of DVD-equipped PCs is between five and eight million, signaling the format's unparalleled acceptance among consumers in North America. With DVD-Audio specifications finally established, and with consumer DVD recorders on the horizon, DVD is the digital video format of the future. Prices for DVD players have been dramatically reduced, ($200-400, with higher end models around $2000) and DVDs at $15-30; computer DVD drives range from $250 to $1500, depending on the brand.

Market penetration was met faster than any other consumer electronics product in history, just three and a half years after its introduction. According to the Consumer

Electronics Association (CEA), compact disc (CD) players took seven years to ship 10 million units; videocassette recorders (VCR) took eight years to reach this level.

Fueling this growth is the enthusiastic support of movie studios and record labels, which are releasing more than 250 new DVD-Video titles each month. Table 3 shows the 17 different DVD movie categories available to choose from. As of June 2000 there were just over 9,000 titles available in the U. S. (over 13,000 worldwide).

Table 3. DVD Movie Categories

DVD movies Categories		
Action/Adventure	Family	Special
Adult	Foreign	Sports
Classic	Horror	Suspense
Comedy	Music	Television
Documentary	Sci-Fi	Western
Drama	Serials/Shorts	

1. DVD Production

The DVD takes existing technology (compact disk) and dramatically enhances it. DVD technology begins with a blank mirrored disk and burns 1's and 0's into its surface, creating a new DVD. When information is burned onto the different levels of the DVD, 4.7 – 17 gigabytes of data can be stored (seven times greater than a typical CD). The DVD player works similar to a CD player; both use a laser to read the stored information, by bouncing a laser beam off the disc, and convert it to audio and video signals for your entertainment system.

Current commercial DVD players are not able to record, but the technology is not too far off to allow for a relatively cheap player to be marketed. DVDs do offer better options than are available on videocassette, such as multiple camera angels, different languages, and the optimal choice of layout (letter box or full screen) in addition to a better resolution. All major movie studios and most major music studios support DVDs.

2. DVD Scratches

Data is stored on DVDs using powerful error correction techniques that can recover from scratches as big as six millimeters with no loss of data. Most scratches will cause minor channel data errors that are easily corrected. A common misperception is that a scratch will be worse on a DVD than on a CD because of higher storage density and because video is heavily compressed. DVD data density is physically four times that of CD-ROM. DVD error correction is at least 10 times better than CD-ROM error correction.

3. DVD Laser

A unique, red laser, developed by Panasonic's parent company, Matsushita Electric Industrial Co., Ltd., has a thinner beam with a shorter wavelength (compared to a CD laser) that accurately reads densely packed information, allowing 4.7 gigabytes to be stored on a single layer DVD disc. Panasonic engineers also developed a process that utilizes ultraviolet light and a photo-polymer resin to combine two DVD layers. Figure 6

provides a visual description of the above-mentioned process. This information has been shared with the industry to allow for conformity.

DVD 5
Single sided, single layer
4.7 GB, 133 minutes

DVD 9
Single sided, double layer
8.5 GB, 241 minutes

DVD 10
Double sided, single layer
9.4 GB, 266 minutes

DVD 18
Double sided, double layer
17 GB, 482 minutes
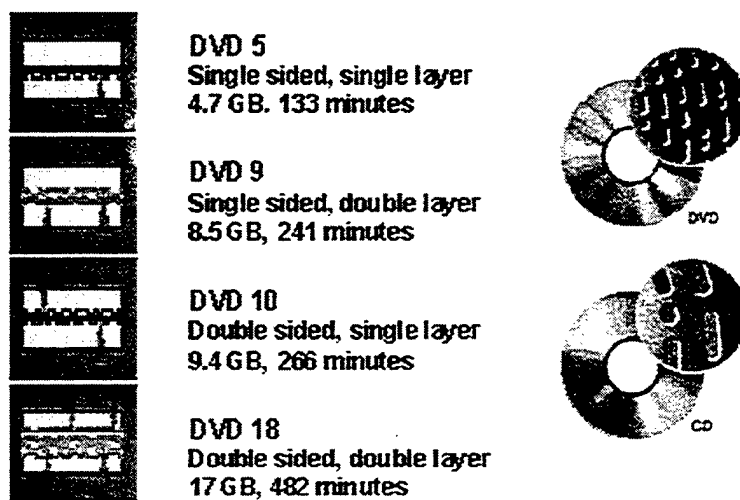
Figure 6.   DVD Types and Layers
After: Technicolor Web Page, August 2000

4. DVD Storage Capacity

DVD discs are the same size as a CD, but are able to hold up to 17 gigabytes of information. Table 4 shows that there are four different types of DVDs, with varying capacities (4.7-17 Gbytes) for storage. Multiple disc layers and high intensity lasers allow for increased storage capacity. Appendix F has industry specifications for DVD disc comparison.

Table 4.   DVD Storage Capability

Medium	Storage
Compact Disc (CD)	0.7 Gbytes
DVD-5	4.7 Gbytes
DVD-9	8.5 Gbytes
DVD-10	9.4 Gbytes
DVD-18	17.0 Gbytes

5. The Features of a DVD-Video

- Over 2 hours of high-quality digital video (a double-sided, dual-layer disc can hold 8 hours of high-quality video, or 30 hours of VHS quality video).

- Support for widescreen movies on standard or widescreen TVs (4:3 and 16:9 aspect ratios).

- 8 tracks of digital audio (for multiple languages).

- 32 subtitle/karaoke tracks.

- Automatic "seamless" branching of video (for multiple story lines or ratings on one disc).

- Up to 9 camera angles.

- Menus and simple interactive features (for games, quizzes, etc.).

- Multilingual identifying text for title name, album name, song name, cast, crew, etc.

- Instant rewind and fast-forward.

- Instant search to title, chapter, music track, and time code.

- Durable (no wear from playing, only from physical damage).

- Not susceptible to magnetic fields. Resistant to heat.

- Compact size (easy to handle, store, and ship; players can be portable; replication is cheaper than tapes or laserdiscs).

- Noncomedogenic (not prone to disc errors).

Note: Most discs do not contain all features (multiple audio/subtitle tracks, seamless branching, parental control, etc.), as each feature must be specially authored. Some discs may not allow searching or skipping.

Most players support a standard set of features:

- Language choice (for automatic selection of video scenes, audio tracks, subtitle tracks, and menus).

- Special effects playback: freeze, step, slow, fast, and scan (no reverse play or reverse step).

- Parental lock (for denying playback of discs or scenes with objectionable material).

- Programmability (playback of selected sections in a desired sequence).

- Random play and repeat play.

- Digital audio output (PCM stereo and Dolby Digital).

- Compatibility with audio CDs.

Some players include additional features:

- Component video output for higher quality picture.

- Progressive-scan component output for highest quality analog picture.

- Digital video output for a perfect digital picture.

- Six-channel analog output from internal audio decoder.

- Recognition and output of DTS Digital Surround audio tracks.

- Compatibility with Video CDs or Super Video CDs.

- Compatibility with laserdiscs and CDVs.

- Compatibility with MP3 CDs.

- Ability to play DIVX discs.

- Reverse single frame stepping.

- Reverse play (normal speed).

- RF output (for TVs with no direct video input).

- Multilingual on-screen display.

- Digital zoom (2x or 4x enlargement of a section of the picture; player feature, not a DVD disc feature).

Various companies provide many reasons for purchasing their products. Table 5 provides the reader with the industry's top 10 reasons to change from tape to DVD.

Table 5.   DVD - 10 Reasons to Change

1) DVD Video offers superior picture and sound with digital video and multi-channel surround sound.

2) DVD Videos are the same size as a CD, but can store an entire film on one side!

3) More than 40 models of DVD Video players representing 30 familiar consumer brands with prices starting for less than $300.

4) More than 9,000 movies and music videos available including hit movies, re-released classics, children's favorites and innovative concerts.

5) Titles are available for sale or rent at prices comparable with VHS tapes.

6) A variety of special features offered on DVD titles, including "behind the scenes" commentary, the ability to control the camera angles, foreign languages and subtitles, trailers and uncut versions.

7) Most DVD Video titles are available in Widescreen and Fullscreen format.

8) DVD Video offers immediate scene access; no rewinding or fast forwarding.

9) Audio CDs will play in DVD Video players.

10) DVD Video players do not require head cleaning.

A double-layer, double sided DVD disc can store 17 gigabytes of information, which is more than 11,500 floppy discs (120 feet high)!
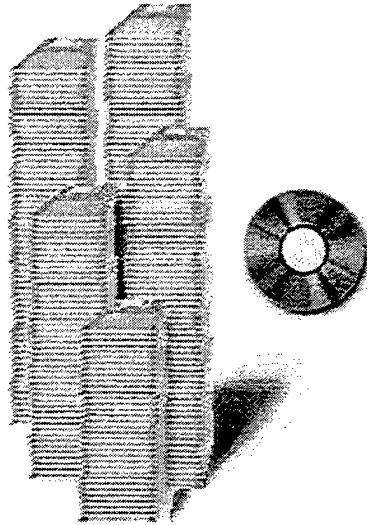
Figure 7.   11,500 Floppy Discs
From: Delaware Micrographics Inc., Products and Services Web Page, August 2000

MPEG-2 (Moving Pictures Expert Group) condenses video by looking for redundant or repetitive image signals (such as the background of a static shot in a movie). Rather than continuously repeating this information, it uses it once until the scene or action changes. The result is the capability to encode up to eight hours of digital video on a double-sided, dual-layer DVD!

One advantage of DVD is the picture quality. It's more than twice as sharp as a VHS tape, with 500 lines of resolution instead of 240 for VHS and 450 for laserdisc. Since DVDs don't use magnetic tape, they will not deteriorate under heavy use.

6. Copy Write Protection and Duplication Issues

a. Content Protection System Architecture

CPSA (content protection system architecture) is the name given to the overall framework for security and access control across the entire DVD family. Developed by Intel, IBM, Matsushita, and Toshiba, in cooperation with the Copy Protection Technical Working Group (CPTWG), it covers encryption, watermarking, protection of analog and digital outputs, and so on. There are six forms of content protection that apply to DVD.

(1) Analog CPS (Macrovision). Videotape (analog) copying is prevented with a Macrovision 7.0 or similar circuit in every player. The general term is APS (Analog Protection System). Computer video cards with composite or s-video (Y/C) output must also use APS. Macrovision adds a rapidly modulated colorburst signal ("Colorstripe") along with pulses in the vertical blanking signal ("AGC") to the composite video and s-video outputs.

(2) CGMS. Each disc also contains information specifying if the contents can be copied. This is a "serial" copy generation management system (SCMS) designed to prevent copies or copies of copies. The CGMS information is embedded in the outgoing video signal.

(3) Content Scrambling System (CSS). Because of the potential for perfect digital copies, movie studios forced an additional copy protection requirement into the DVD standard. Content Scrambling System (CSS) is a data encryption and authentication scheme intended to prevent copying video files directly from the disc.

Matsushita and Toshiba corporations developed CSS. Each CSS licensee is given a key from a master set of 400 keys that are stored on every CSS-encrypted disc, allowing the license to be revoked from future discs. All DVD-ROM drives have extra firmware to exchange authentication and decryption keys with the CSS module in the computer.

(4) Content Protection for Prerecorded Media (CPPM). CPPM replaces CSS for DVD-Audio. Keys are stored in the lead-in area, but there are no title keys in the sector headers. An "album identifier" replaces the disc key. The authentication mechanism is the same as for CSS, so no changes are required to existing drives. A disc may contain both CSS and CPPM content.

(5) Content Protection for Recordable Media (CPRM). CPRM, supported by all DVD recorders, is a mechanism that ties a recording to the media on which it is recorded. Each blank recordable DVD has a unique 64-bit disc ID etched in the BCA. When protected content is recorded onto the disc, it can be encrypted with a 56-bit C2 (Cryptomeria) cipher derived from the disc ID. During playback, the disc ID is read from the BCA and used to generate a key to decrypt the contents of the disc. If the contents of the disc are copied to other media, the ID will be absent or wrong and the data will not be decryptable.

(6) Digital Copy Protection System (DCPS). DCPS in general is designed for the next generation of digital TVs, digital receivers, and digital video recorders. Under DTCP, devices that are digitally connected, such as a DVD player and a digital TV or a digital VCR, exchange keys and authentication certificates to establish a secure channel. The DVD player encrypts the encoded audio/video signal as it sends it to

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the receiving device, which must decrypt it. This keeps other connected but unauthenticated devices from stealing the signal.

b. DVD Region Codes

Motion picture studios want to control the home release of movies in different countries because theater releases are not simultaneous (a movie may come out on video in the U.S. when it is just hitting screens in Europe). Also, studios sell distribution rights to different foreign distributors and would like to guarantee an exclusive market. Therefore they have required that the DVD standard include codes that can be used to prevent playback of certain discs in certain geographical regions. Each player is given a code for the region in which it is sold. The player will refuse to play discs that are not allowed in that region. This means that discs bought in one country may not play on players bought in another country. Some people believe that region codes could be considered an illegal restraint of trade, but no legal cases were found.
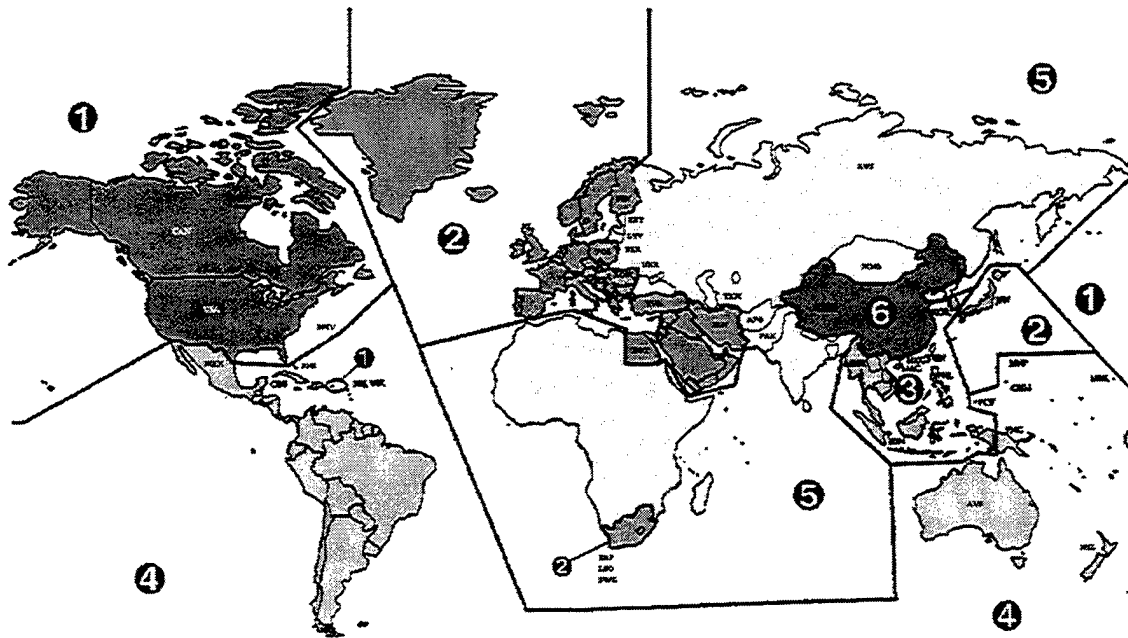
Figure 8.   DVD Regions
From: DVD Demystified Web Page

Regional codes are entirely optional for the disc maker. Discs without codes will play on any player in any country. It's not an encryption system, it's just one byte of information on the disc that the player checks. Some studios originally announced that only their new releases will have regional codes, but so far almost all releases play in only one region. Region codes are a permanent part of the disc, they will not "unlock" after a period of time.

There are eight regions (also called "locales"). Table 6 provides the eight DVD region codes and their associated regions. The region number superimposed on a world globe (figure 8) identifies players and discs. If a disc plays in more than one region it will have more than one number on the globe.

Table 6.   DVD Region Codes

Code	Region
1	U.S., Canada, U.S. Territories
2	Japan, Europe, South Africa, and Middle East (including Egypt)
3	Southeast Asia and East Asia (including Hong Kong)
4	Australia, New Zealand, Pacific Islands, Central America, Mexico, South America, and the Caribbean
5	Eastern Europe (Former Soviet Union), Indian subcontinent, Africa, North Korea, and Mongolia
6	China
7	Reserved
8	Special international venues (airplanes, cruise ships, etc.)

From: DVD Demystified Web Page

B.   PROPOSED DVD SYSTEMS

The proposed DVD authoring system has not been approved by Naval Media Center, nor has there been a Request For Proposal (RFP), Invitation For Bid (IFB), or an official decision, regarding any replacement video system. The Naval Media Center is reviewing many possibilities, some of which will be mentioned in the Recommendations for DoD section in Chapter V.

1.   DVD Authoring and Mastering

The majority of DVDs being created today are done using Sonic Solutions' *Sonic DVD Creator* (figure 9) system. Other companies, such as Spruce technologies (*DVD Maestro*) also produce comparable products.
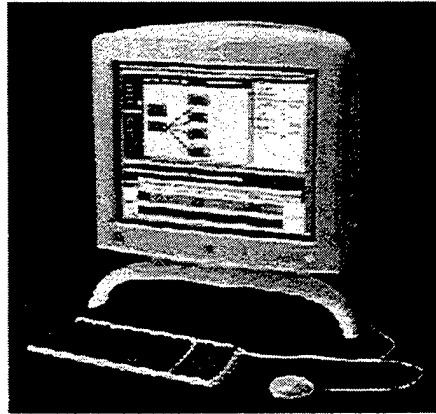
Figure 9.   DVD Creator
From: Sonic Web Page

Sonic DVD creator uses a desktop computer to integrate DVD-Video and DVD-ROM production. The program's built-in project planning assistant, drag-and-drop authoring, and ability to directly transcode QuickTime® (MPEG-2) video and Dolby Digital audio, allow the producer to make quick production discs (DVD-R). The DVD creator lists for $35,000. The Desktop computer is a modified Macintosh personal computer (PC) that lists for $7000. Additionally, the user will need to purchase DVD duplication drives (burners), which list for about $5,000 each.

Typical DVD Production Procedure
Production Flow of Discs
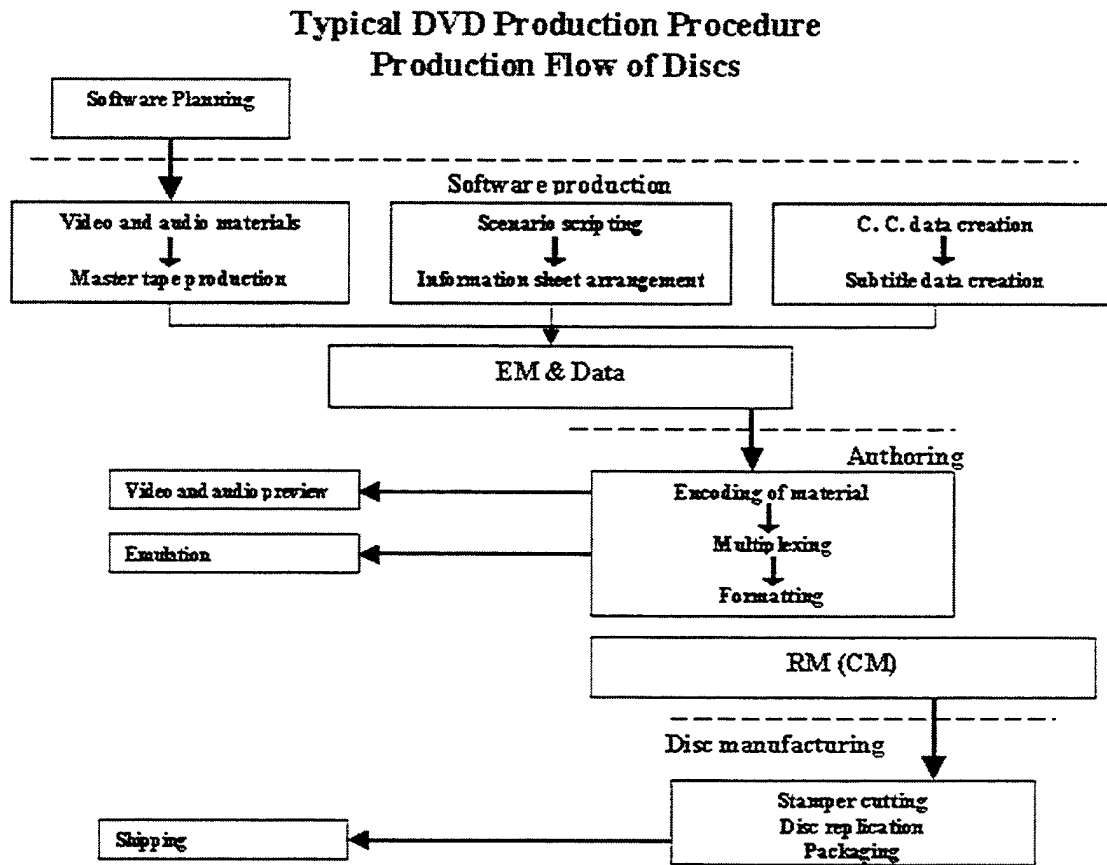
Figure 10.   DVD Production Process
From: Americ Disc Inc.

2. DVD Players

There are literally hundreds of DVD players available on the market. This research provides a very limited sample based on the 8mm player refurbishment ($550 ea) cost. Below are five medium priced (randomly chosen) DVD players. Actual acquisition costs will vary depending on the amount purchased per year and actual model chosen. I will use $300 as a base line price for this analysis.

Table 7.	DVD Players			
Panasonic	Sony	Toshiba	Pioneer	Pioneer
DVD-RV30	DVPS560D	SD2200	DV-333	DV-434
$249.95	$299.95	$299.95	$299.95	$349.95

The intention of Table 7 is not to recommend one of the above DVD players, but to show the wide variety of players available for public consumption. As the public readily accepts DVDs, the price for these players should continue to drop. Price drops are not included in this analysis when considering future player costs.

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IV. DATA ANALYSIS

Data was obtained from various sources, including personal interviews, e-mail correspondence and web based queries. The information contained here is only a small portion of the available data. The references listed provide a focus for the curious reader and the financial manager.

A. MAINTENANCE AND TRAINING

Every command performs limited maintenance on their system and training for its operators.

1. Naval Media Center

While the Naval Media Center is responsible for operations in the entire fleet, SIX Fleet Support Detachments (FSDs) provide localized training and assistance. Every ship has personnel that are trained to operate the CCTV system. Usually these personnel are in the ET and IC ratings. They are responsible for the daily operation and preventative maintenance (PMS) associated with the CCTV system. If an equipment failure occurs, the site tech and site officer will contact Naval Media Center via radio message to arrange for a direct exchange of the disabled unit. The site techs are not allowed to repair the equipment. If the ship is in port it will be able to arrange a direct exchange with the local FSD.

Each year, 425 to 600 units are repaired.[2] All units are repaired under a contract with Sony. The life expectancy for a refurbished player is 350 hours. New construction ships are given refurbished equipment and racks with new cabling and DTS equipment. The exact number of repaired units was not available, so Table 8 reflects the refurbishment contract batch allowances.[3] Any players in excess of 600 would be repaired at a competitive market rate.

Table 8.   8mm Player Repair Costs

Units per year	Cost Per Unit	Toal Cost
425	$550	$ 233,750
450	$550	$ 247,500
500	$550	$ 275,000
550	$550	$ 302,500
600	$550	$ 330,000

From: Naval Media Center Detachment San Diego, July 2000

a.   *Direct Exchange*

The replacement of non-functioning 8mm players in the fleet is called Direct Exchange (DX). The Navy (Naval Media Center) has outsourced the contract with Federal Express Company (FEDEX®) to store replacement 8mm players in their Memphis warehouse. All 8mm players are sent to Memphis for repair, under a contract with SONY. Repaired units are returned to the DX stock in Memphis. DX units are shipped within 24 hours to locations within CONUS. The Fleet Post Office (FPO) then forwards the unit to the ship's location. Total shipping time depends on FPO Mailing

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[2] 425 to 600 8mm players were obtained from Naval Media Center for FY2000. Each year a batch repair contract with SONY is negotiated. Actual numbers of players repaired in previous years was not provided for analysis.
[3] After numerous inquiries with Sony and the Naval Media Center (including traveling to Naval Media Center Headquarters in Washington DC), both organizations declined to provide accounting data.

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plus FEDEX® (one day). Exact warehouse numbers and shipping data were not provided.[4] Additionally, the Fleet Support Detachments (FSDs) maintain a small inventory of 8mm players (Norfolk and San Diego usually have 15 players each).

2. Training Technology

The Chief of Naval Operations Office of Training Technology (OTT) Seamless Product Information, Data Exchange and Repository (SPIDER), is the Navy's premier on-line resource for training technology data and information. OTT-SPIDER was designed to provide the widest possible range of information resources to assist in the analysis, development, procurement, and implementation of training technologies. Multimedia Contracts (MMC) allow the government to easily purchase training products related to traditional stand-up instruction, correspondence courses, medium and highly interactive computer-based training, interactive video discs, multimedia CD-ROMs, and training support packages for video teletraining -- any kind of training products for interactive multimedia instruction (IMI).

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[4] After numerous inquiries with FEDEX and the Naval Media Center (including traveling to Naval Media Center Headquarters in Washington DC), both organizations declined to provide accounting data.

B.   TAPE ACQUISTION AND DISTRIBUTION

1.   Navy Motion Picture Service

The Navy Motion Picture Service (NMPS) obtains 12,400 tapes for monthly distribution to its DoD customers. Every command receives sixteen additional 8mm tapes each month. Table 9 provides the reader with a breakdown of NMPS' annual costs.

Table 9.   NMPS Production & Distribution Costs

Shipments per month	Video Tapes	Cost per tape	Weight	Postage & Insurance
755	16[5]	$10.50	2.71lbs[6]	$6.10 per box
Tape cost (per month) $126,840.00			Shipping cost (per month) $4,605.50	
Total tape cost (Annual) $1,522,080.00			Total shipping cost (Annual) $55,266.00	
Combined Annual Cost $1,577,346.00				

From: Navy Motion Picture Service, August 2000

Additionally, NMPS pays $35,000-65,000 per title for the four-year leasing rights. The lease includes the initial use of the 35mm film rights and the 8mm lease. These costs would be similar to DVD costs and will not be used in my analysis.

2.   Armed Forces Radio and Television

AFRTS supplies deployed commands with TW units every two weeks. Table 10 breaks down the 16 circuits' annual shipping and tape costs. The total cost will be used in the final analysis.

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[5] Longer length movies require 2 tapes
[6] Postage is paid on a 3lb box

Table 10.   AFRTS Television Weekly Production & Distribution Costs

Circuits	Tapes per shipment	Tape cost	Production	Shipping	Total Cost
-	24	$ 4.50 (per tape)	$ 8.00 (per tape)	-	-
16	384	$ 1,728	$ 3,072	$ 230	$ 5,030
Annual Costs (26 bi-weekly shipments)					
16	9,984	$ 44,928	$ 79,872	$ 5,980	$ 130,780

From: Armed Forces Radio and Television Service, July 2000

3.   Other Department of Defense Providers

The Department of Defense (DoD) has many individual commands that produce and distribute their own CD-ROM and video products.

a.   DISA

The Defense Information Systems Agency (DISA) provides DoD clients with a limited CD-ROM production capability. Batch order production is required prior to distributing all CD-ROM products. The information provided in Table 11 is for FY2000. The production costs of CD-ROMs and DVDs are dependant on numbers produced. Economies of scale are provided.

Table 11.   DISA CD-ROM Production Costs

Single CD with jewel case		2CDs with jewel case	
Quantity	Cost per unit	Quantity	Cost per unit
1,000	$2.09	1,000	$3.17
6,000	$1.50	5,000	$2.44

From: Defense Information Systems Agency, August 2000

b. AFIS/DVI-JVISDA

As of 30 June 2000, NETPDTC no longer provides library services to the Fleet. Videos and other visual information products are ordered directly from the Joint Visual Information Services Distribution Activity (JVISDA), located in Tobyhanna, PA. They stock products from all branches of DOD and offer many video and IMI products. Their catalog lists over 3,500 products stocked specifically for Naval education and training programs.

JVISDA distributes several Navy VHS and CD-ROMs. The Navy allows commands (CNET, PERS, CRUITCOM, etc.), to do their own distributions as they choose. Costs are based upon running times of the video, number of copies, adjunctive materials, labeling, and shipping costs (which are an automatic $1.33 per addressee). If the SNDL (Standard Navy Distribution List) is used, and the Major Claimant decides to go Navy-wide, the Fleet would be included. However, there are times when the Claimant only distributes to particular addressees (ROTC's, Recruiting, etc.). SUBGRU (all submarines listing) also has an exception and does their own distributions, the FAILSAFE group makes their own copies and drop ships them to the distribution center where they reimburse shipping costs (FAILSAFE encompasses only 80 copies - no ships).

FY2000 records (Table 12) indicate that there were a total of 15 titles shipped, involving 30,248 VHS copies; $35,981.29 was received for reimbursement. The Bureau of Medicine (BURMED) drop shipped (already produced prior to delivery), 3,187 copies of the AIMM CD-ROM's.

Table 12.   AFIS VHS/CD-ROM Production Costs

AFIS FY 2000 DON Media Distribution	
VHS Tapes	AIMM CD-ROMs
30,248 copies	3,187 copies
$ 35,981.29	* BUMED covered production costs
$ 1.33 per addressee – shipping	$1.33 per addressee - shipping

From: AFIS - Department of Defense Distribution Center

As of October 2000, the Department of Defense Distribution Center has been advised to retain full VHS capabilities. DVD conversion has been discussed, but with budget constraints, has not been implemented.

4.   Commercial DVD Providers

Commercial firms provide information on duplication that does not include volume discounts. The Department of Defense should be able to negotiate a contract that exploits the large volume required. Videotapes do not have a mastering cost but run about $2.40 for replication. CDs cost about $1,000 to master and $0.50 to replicate. As of June 2000, DVDs cost about $1,000 to master and about $1.60 to replicate. Table 13 summarizes production costs for videotape, compact discs (CDs), and DVDs. Since DVD production is based mostly on the same equipment used for CD production, mastering and replication costs should eventually drop to CD levels.

Table 13.   Commercial Production Cost Comparison

Video Tape	Compact Discs	DVDs
Mastering Costs		
S 0	S 1,000	S 1,000
Production Costs (per copy)		
S 2.40	S 0.50	S 1.60

From: DVD Source Web Page, August 2000

If DVD volume exceeds 1,000 units, the cost of each unit is about S1.00. This assumes that the input is a fully authored digital linear tape (DLT). The DLT, marketed by Quantum, is capable of transferring data at 80 MB per minute; twice as fast as established 4 mm and 8 mm tape media.

C.   SUMMARY OF DATA

Assumptions are stated in the explanatory paragraphs that follow each Table (14-16). With the conversion to DVDs, there is the potential to save over S1,080,595 in just four years, with further cost reductions (up to S1,116,536) by increasing the DVD disc program time from two to four hours.

1.   8 Mm Tape and Player Costs

Tables 14-15 provide a summary look at data associated with the maintenance of 8mm players and costs associated with the Television Weekly (TW) program. The actual number of 8mm players that are repaired each year was unavailable.[7] Annual batch data requirements were provided by Naval Media Center, San Diego. Naval Media Center headquarters verified the batch figure and said, "All players were repaired as required."

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[7] Naval Media Center declined to disclose this information.

This analysis used the median value (500 players-Table 7) for the comparison analysis. Armed Forced Radio and Television Service (AFRTS) provided all required information relevant to the Television Weekly (TW) and Direct to Sailor (DTS) services. The TW information was taken from Table 10. The tape production cost ($12.50), not the acquisition cost ($4.50 per tape), was used for this analysis because I recommend that the Naval Media Center duplicating facilities (DUPFAC) provide this service in the future.

Table 14.   Projected 8mm Video Player Maintenance and Tape Costs

Annual Maintenance Cost	Year 1 $275000	Year 2 $283250	Year 3 $291747.5	Year 4 $300499.925
Annual TW Units Cost	Year 1 $ 44,928.00	Year 2 $ 46,275.84	Year 3 $ 47,664.12	Year 4 $ 49,094.04
8mm Total Cost	$325,908.00	$335,685.24	$345,755.80	$356,128.47

From: AFRTS and Naval Media Center

Inflation was estimated at 3% annually (Table 14) and the present value factors (Table 15) were taken from OMB circular A-94 to present the real discount rate.

Table 15.   Real Discount Rate

Year	1	2	3	4
Rate (%)	0.037	0.0375	0.038	0.0385
Discounted 8mm Total Cost				
Present Value	325,908.00	$323,708.04	$333,258.60	$343,091.01

After: OMB Circular A-94– Real Discount Rate, Jan. 2000

2.   DVD Disc and Player Costs

After multiple on-line queries, the median price of a DVD player was determined to be $300 (see Table 7). The DVD player acquisition rate was determined by replacing the existing 8mm players (see Table 2) over four years (175 players each year). Table 16

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provides the projected annual cost of player acquisition and disc replacement for TW

units. No adjustments were made for inflation or future pricing.

Table 16.   DVD Player and Disc Costs

DVD Player Acquisition	Year 1	Year 2	Year 3	Year 4
	$ 52.500.00	$ 52,500.00	$ 52.500.00	$ 52.500.00
TW Units Disc Cost	Year 1	Year 2	Year 3	Year 4
2.0 Hour Disc (2.0 H/D)	$ 15.974.40	$ 15,974.40	$ 15.974.40	$ 15,974.40
4.0 Hour Disc (4.0 H/D)	$ 7,987.20	$ 7,987.20	$ 7,987.20	$ 7,987.20
TW Shipping	$	6.00 per unit (2.0 Hours/Disc)		
Annual Shipping Cost	Year 1	Year 2	Year 3	Year 4
2.0 Hour Disc (2.0 H/D)	$ 2.496.00	$ 2.496.00	$ 2.496.00	$ 2.496.00
4.0 Hour Disc (4.0 H/D)	$ 1,248.00	$ 1,248.00	$ 1,248.00	$ 1.248.00
DVD Total Cost (2.0 H/D)	$ 70.970.40	$ 70.970.40	$ 70.970.40	$ 70.970.40
DVD Total Cost (4.0 H/D)	$ 61.735.20	$ 61.735.20	$ 61.735.20	$ 61.735.20

I did not include the acquisition cost of the DVD authoring and mastering

equipment in Table 16, since these will be sunk costs. DVD authoring and mastering

data was provided in Chapter III. DVD player costs were estimated at $300. I was able

to view various electronic equipment websites for DVD player cost. The range for a

single DVD disc player is $200-400, with high-end units approaching $1000. This

assumption does not include the potential cost reductions for future acquisitions.

The potential annual savings can run as high as $1 million in just four years. Table 17 provides the annual projected savings for the conversion of DVD players and by using a two or four hour disc for Television Weekly (TW) service.

Table 17.   Potential Annual Savings

	Year 1	Year 2	Year 3	Year 4
Total 8mm Cost (From Table 15)	$325,908.00	$323,708.04	$333,258.60	$343,091.01
Total DVD Cost (2.0 H/D) (From Table 16)	$ 70,970.40	$ 70,970.40	$ 70,970.40	$ 70,970.40
Total DVD Cost (4.0 H/D) (From Table 16)	$ 61,735.20	$ 61,735.20	$ 61,735.20	$ 61,735.20
Net Savings (2.0 H/D)	$254,937.60	$264,714.84	$274,785.40	$285,158.07
Net Savings (4.0 H/D)	$264,172.80	$273,950.04	$284,020.60	$294,393.27

The data provided in this chapter were used to deliver a basic understanding of the existing cost structure for the 8mm program and project a potential cost savings for the particular scenario previously explained. This is not the only solution, nor does it include all factors needed for contract negotiations. Further research (beyond the scope of this study) will be able to provide specific data for analysis.

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V. CONCLUSIONS AND RECOMMENDATIONS

A. THESIS CONCLUSIONS

The overall conclusion of this study recommends the phased replacement of the existing 8mm Closed Circuit Television (CCTV) System with a Digital Video Disc (DVD) System. The Navy could save over one million dollars in maintenance and shipping costs, improve CCTV system reliability, and improve the quality of shipboard training. Additional studies should be conducted to validate the assumptions made in this thesis and ensure cost savings to DoD and the Navy. Specifically, this study addressed three specific questions concerning potential cost savings. These questions and their answers can be summarized as follows:

1. What are the costs and benefits (economic, maintenance, system availability, and quality of life) of improving or replacing the Navy's closed circuit television system?

Improving the existing CCTV system with a phased replacement over four-years would: improve the existing systems' reliability and reduce maintenance requirements; enhance the picture display of videos (movies and training films) played on the system; and allow the Navy to phase the acquisition costs for new players. The four-year phased replacement of 8mm video players with DVD players would spread the costs associated with the conversion (acquisition and installation) while allowing the Navy to continue using existing 8mm tape rights (four years). Once the four-year period is completed, the Navy will have replaced the existing CCTV system with a DVD system. An additional benefit of DVD coinciding with enhanced picture quality is enhanced quality of life for

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deployed service members. Although not qualified here, it is reasonable to expect a positive effect on retention.

2. What are the comparative costs, benefits, and savings associated with converting the Navy's closed circuit television system to a digital videodisc system?

Comparing the costs, benefits, and savings for converting from a 8mm video system to a DVD system, revealed a one million dollar savings in four years. Acquiring DVD players would cost approximately $210,000 over the four year phased replacement. Acquisition cost data is provided in Chapter IV (Table 16). Reductions in the maintenance costs for the existing 8mm players would save approximately $1,150,000 over the same period. Maintenance cost data is summarized in Chapter IV (Table 14). DVD players require less maintenance than 8mm players. Finally, converting the Television Weekly (TW) units to DVD would capture an additional $ 125,000 savings.

There are a few disadvantages for replacing the existing system with DVDs. Specifically, the ability to record is currently not available on the lower priced DVD players and not all videos released on VHS and 8mm tape are available on DVD. These limitations are minor compared to the cost savings and system improvements. After the phased replacement is completed, the market may have adjusted to provide low cost recorder players and an extensive video selection.

3. What are the comparative costs, benefits, and savings associated with converting the navy's training library to a digital videodisc system?

Converting the Navy's existing training tapes to a DVD format does not appear to be cost effective, however, acquiring DVDs in the future would help modernize training capabilities and decrease storage requirements. DVDs allow for increased training on demand. Using personal computers, service members can self-administer individualized DVD training without interrupting the CCTV television schedule. Additionally, DVDs require considerably less storage requirements-a plus for shipboard space utilization.

The gradual conversion of the Navy's training library to DVD would coincide with the Chief of Naval Operations' direction to continually improve training delivery methods and technology. Increased training on demand, reduced storage, and enhanced picture quality are desirable and attainable results.

In summary, converting the existing CCTV and training tape systems to a DVD system will reduce costs and maintenance requirements, improve the quality of videos used for training and entertainment, and increase modernization using off the shelf technology. There are a few limitations for converting to a DVD system, but the advantages appear to outweigh the disadvantages.

B. RECOMMENDATIONS FOR DOD

The Department of Defense (DoD) should consolidate recorded media providers in both the entertainment and training fields. DoD can achieve economies of scale by reducing its need for each service to duplicate products, missions, and services. Centralizing redundant functions appears to be an attainable and realistic goal.

Specifically, DoD should consolidate Armed Forces Radio and Television Service (AFRTS) Television Weekly (TW) units with Naval Media Duplication Services (DUPFACs). The fleet relies on the television products delivered by the Armed Forces Radio and Television Service (AFRTS). Advantages from consolidation include cost reductions and quality of life improvements. Allowing forward deployed DUPFACS to provide product to the fleet reduces time delays for shipping the TW units and allows all ships in the circuit to view product at the same time, improving quality of life. Additionally, the transfer of TW unit production to the DUPFACs would result in saving approximately $30,000 each year by reducing the amount of product provided by commercial firms. Finally, shipping requirements would be reduced saving approximately 6,000 dollars annually.

Additionally, the DoD can reduce training costs by fully utilizing the Defense Visual Information (DVI) Service. Beginning July 1, 2000, official Navy videotapes could only be ordered from DVI. DVI has begun to provide limited product (CD and tape) distribution for all DoD entities, but each service still uses its own distribution chain, duplicating similar services across the military services.

C.   SUGGESTED FURTHER STUDIES

This study explored potential cost savings and consolidation issues concerning the Navy's closed circuit television enterprise. Additional recommended areas for study may include:

1. Examine the alternate use of satellite transmission for television programming and motion pictures.

2. Conduct a Cost Benefit Analysis exploring the modification of the Naval Motion Picture Service 8mm movie program and other movie formats.

3. Explore digital storage capabilities such as Moving Pictures Experts Group (MPEG) technology and/or storage (hard drive) disc.

4. Consider implementation of a Video on Demand system. This technology may reduce operation time needed for the CCTV operators.

5. Conduct a survey to capture retention benefits for improving the CD and videotape training library available to the fleet.

This study has addressed a few options to reduce costs and improve the quality of life onboard U. S. Navy ships. Future research may provide additional insight to these areas and others that will enhance sailors' ability to operate while providing them with the current technologies available in the television industry.

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APPENDIX A. SITE 300 EQUIPMENT RACK

The equipment layout for the Site 300 system was provided by Naval Media DET- San Diego.

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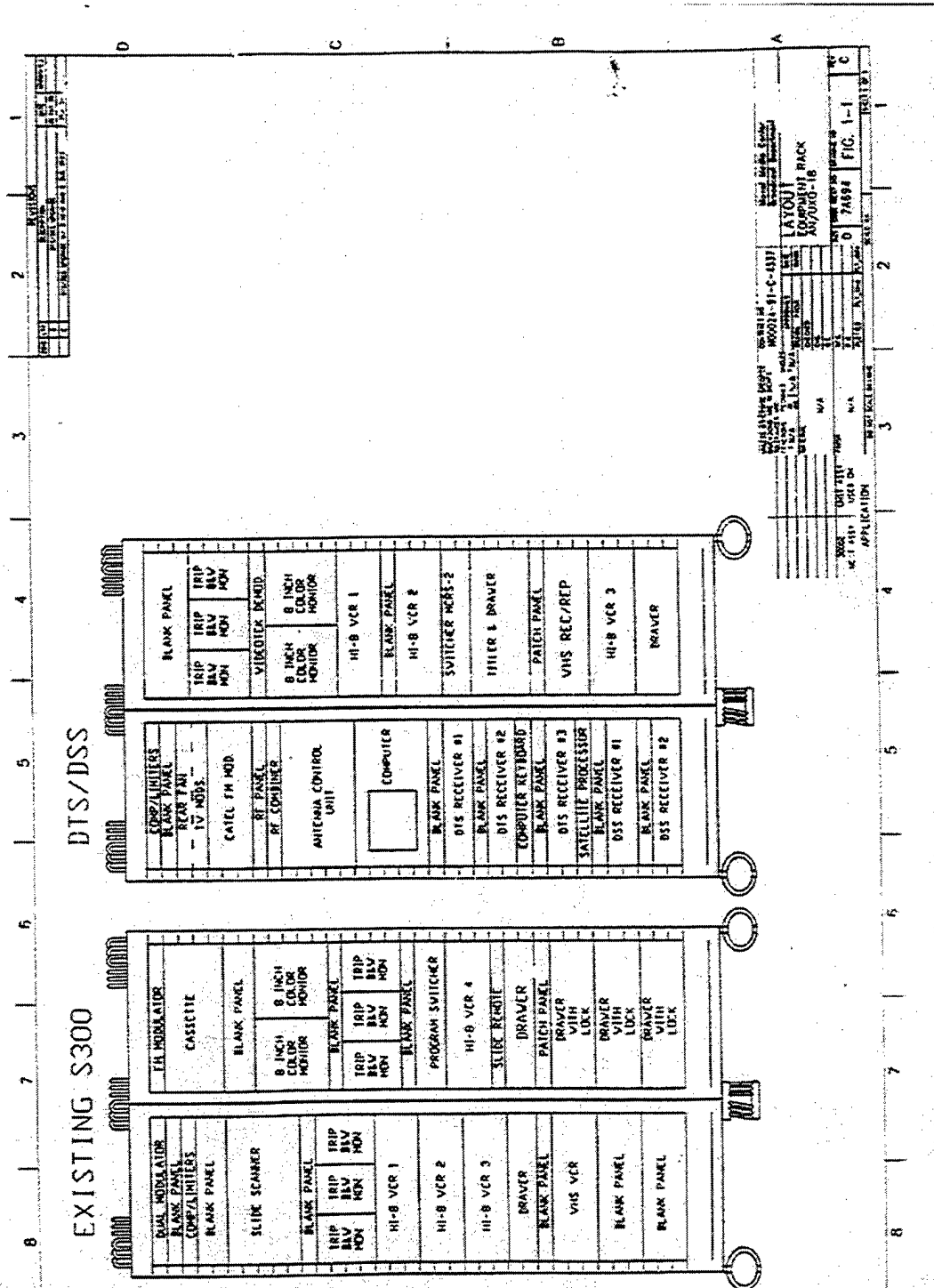
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APPENDIX B. SITE 400 EQUIPMENT RACK

The equipment layout for the Site 400 system was provided by Naval Media DET- San Diego.
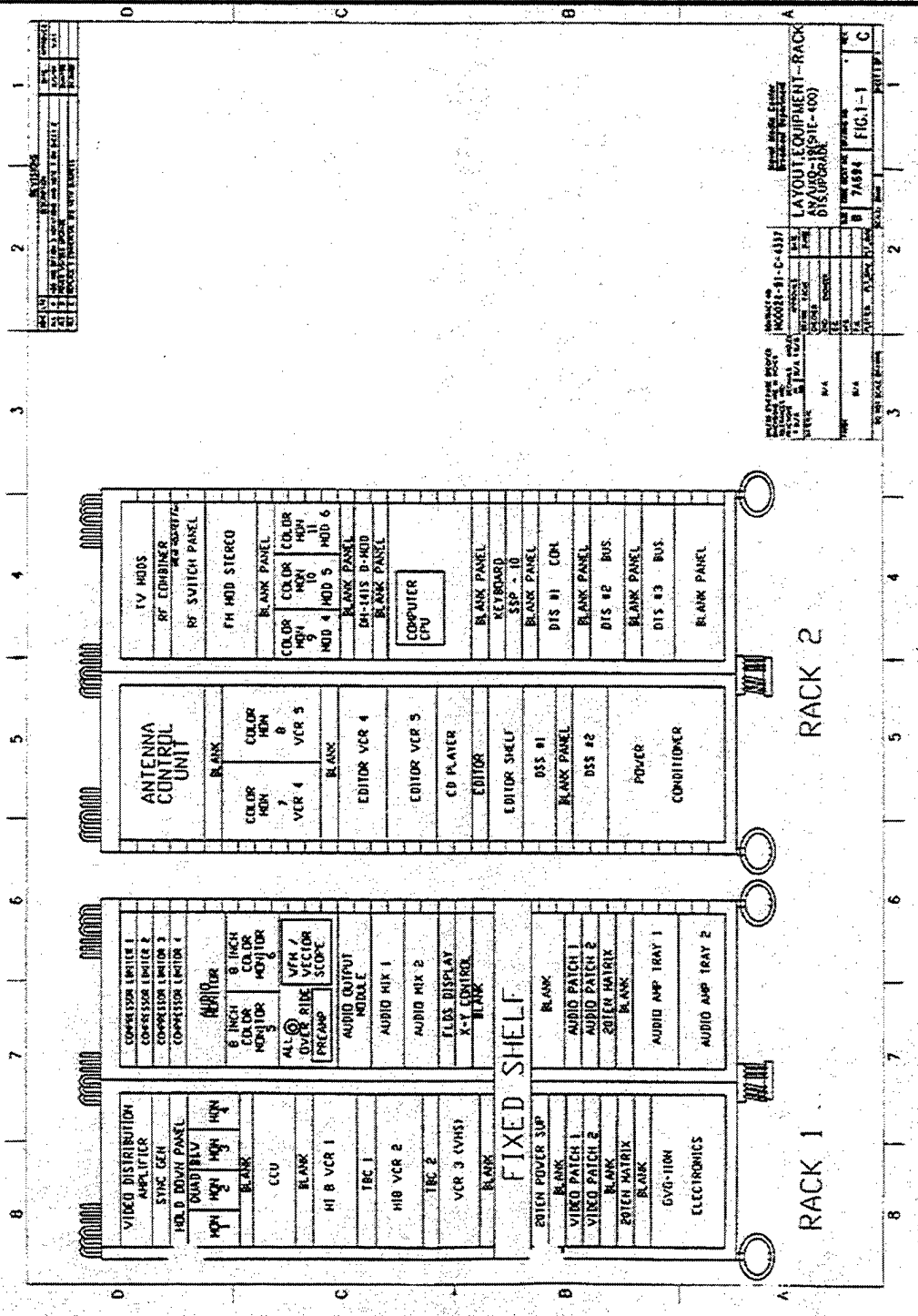
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APPENDIX C. TELEVISION WEEKLY CIRCUIT LIST

Appendix C provides the Television Weekly (TW) circuits (1-16) for the 29th and 30th week of calendar year 2000. The circuit managers (NAVMEDIA - San Diego and Norfolk) determine circuit position.

TW Circuit List (29-0/30-0) Effective: 18 July 2000

Position	ID	Outlet	Location
01 - 01	175	USS WASP (LHD-1)	ATLANTIC FLEET
01 - 02	235	USS TRENTON (LPD-14)	ATLANTIC FLEET
01 - 03	168	USS OAKHILL	ATLANTIC FLEET
01 - 04	222	USS MAHAN (DDG-72)	ATLANTIC FLEET

Position	ID	Outlet	Location
02 - 01	182	USS MOOSBRUGGER	ATLANTIC FLEET
02 - 02	230	USS GRASP	ATLANTIC FLEET
02 - 03	231	USS KAUFFMAN	ATLANTIC FLEET

Position	ID	Outlet	Location
03 - 01	158	USS DWIGHT D EISENHOWER	ATLANTIC FLEET
03 - 02	116	USS KANAWHA (TAO-196)	ATLANTIC FLEET
03 - 03	198	USS ANZIO	ATLANTIC FLEET

Position	ID	Outlet	Location
04 - 01	241	USS BOONE (FFG 28)	ATLANTIC FLEET
04 - 02	234	USNS SIRIUS	ATLANTIC FLEET
04 - 03	43	USNS SATURN (TAFS-10)	ATLANTIC FLEET
04 - 04	245	USS AUSTIN	ATLANTIC

Position	ID	Outlet	Location
05 - 01	50	USS ARTHUR W RADFORD (DD-968)	ATLANTIC FLEET
05 - 02	197	USS BARRY	ATLANTIC FLEET
05 - 03	233	USNS LARAMIE (TAO-23)	ATLANTIC FLEET
05 - 04	24	FSD NORFOLK	VIRGINIA

Position	ID	Outlet	Location
06 - 01	237	USS SAMUEL B ROBERTS	ATLANTIC FLEET
06 - 02	204	USS LABOON	ATLANTIC FLEET

Position	ID	Outlet	Location
07 - 01	90	USS KITTY HAWK (CV-63)	PACIFIC FLEET
07 - 02	64	USS CURTIS WILBUR (DDG-54)	PACIFIC FLEET
07 - 03	91	USS MOBILE BAY (CG-53)	PACIFIC FLEET
07 - 04	57	USS CHANCELORSVILLE (MCM-4)	PACIFIC FLEET

Position	ID	Outlet	Location
08 - 01	54	USS BLUE RIDGE (LCC-19)	PACIFIC FLEET
08 - 02	68	USS DEXTROUS (MCM-12)	PACIFIC FLEET
08 - 03	49	USS ARDENT (MCM-12)	PACIFIC FLEET
08 - 04	243	USS REUBEN JAMES(FFG 57)	PACIFIC FLEET

Position	ID	Outlet	Location
09 - 01	95	USS JUNEAU (LPD-10)	PACIFIC FLEET
09 - 02	93	USS GERMANTOWN (LSD-42)	PACIFIC FLEET
09 - 03	9	COMPSRON THREE	CALIFORNIA
09 - 04	244	USS SIDES (FFG14)	PACIFIC FLEET

Position	ID	Outlet	Location
10 - 01	96	USNS SAN JOSE (TAFS-7)	PACIFIC FLEET
10 - 02	47	USNS YUKON (TAO-202)	PACIFIC FLEET
10 - 03	44	USNS SPICA (TAFS-9)	PACIFIC FLEET
10 - 04	242	USNS OBSERVATION ISLAND	PACIFIC

Position	ID	Outlet	Location
11 - 01	46	USNS TIPPECANOE (TAO-199)	PACIFIC FLEET
11 - 02	38	USNS INVINCIBLE (T-AGOS)	PACIFIC FLEET
11 - 03	40	USNS KILAUEA (AE-26)	PACIFIC FLEET

Position	ID	Outlet	Location
12 - 01	153	USS ABRAHAM LINCOLN	PACIFIC FLEET
12 - 02	196	USS SHILOH	PACIFIC FLEET
12 - 03	245	USS BUNKER HILL	PACIFIC FLEET

Position	ID	Outlet	Location
13 - 01	203	USS PAUL HAMILTON	PACIFIC FLEET
13 - 02	246	USS FLETCHER (DD 992)	PACIFIC FLEET
13 - 03	156	USS CAMDEN	PACIFIC FLEET
13 - 04	247	USS CROMMELIN (FFG 37)	PACIFIC FLEET

Position	ID	Outlet	Location
14 - 01	249	USS OLDENDORF (DD 972)	PACIFIC FLEET
14 - 02	214	USS MILIUS	PACIFIC FLEET

Position	ID	Outlet	Location
15 - 01	220	USS BON HOMME RICARD (LHD-6)	PACIFIC FLEET
15 - 02	221	USS PEARL HARBOR (LSD-52)	PACIFIC FLEET
15 - 03	179	USS DENVER	PACIFIC FLEET

Position	ID	Outlet	Location
16 - 01	239	USS FIFE (DD-991)	PACIFIC FLEET
16 - 02	215	USS HOPPER	PACIFIC FLEET
16 - 03	240	USS JARRETT	PACIFIC FLEET

Total Number of Outlets: 54

The Armed Forces Network (AFN) schedule is available on the Armed Forces Radio and Television Service (AFRTS) web page. The schedule provided in appendix D was for Monday, July 24, 2000.

POT	GMT	Cet	Asia	NewSports	Spectrum	POT	GMT	Cet	Asia	Atlantic	Korea	Pacific	POT	GMT	Cet	Asia
0:00	7:00	9:00	16:00	World Report	Rugrats (TV-Y)	0:00	7:00	9:00	16:00	Oprah Winfrey (TV-14)	Scuigglevision (TV-Y)	Scuigglevision (TV-Y)	0:00	7:00	9:00	16:00
0:30	7:30	9:30	16:30		Aaahh!!! Real Monsters (TV-Y)	0:30	7:30	9:30	16:30	<:55> Port Charles (TV-14)	All That (TV-Y)	All That (TV-Y)	0:30	7:30	9:30	16:30
1:00	8:00	10:00	17:00	CNN International	The Simpsons (TV-PG)	1:00	8:00	10:00	17:00	<:20> Guiding Light (TV-14)	Jeopardy!	Jeopardy!	1:00	8:00	10:00	17:00
1:30	8:30	10:30	17:30	CNN Newsroom	Home Improvement (TV-PG)	1:30	8:30	10:30	17:30		Headline News	Headline News	1:30	8:30	10:30	17:30
2:00	9:00	11:00	18:00	USGA Golf (NBC)	Star Trek: Deep Space Nine (TV-PG)	2:00	9:00	11:00	18:00	<:10> General Hospital (TV-14)	Advisory Block	Pacific Report	2:00	9:00	11:00	18:00
2:30	9:30	11:30	18:30	2000 US Women's Open Championship	The Emperor's New Cloak	2:30	9:30	11:30	18:30		<:33> CNN/SI	<:33> CNN/SI	2:30	9:30	11:30	18:30
3:00	10:00	12:00	19:00		Nova	3:00	10:00	12:00	19:00	Headline News	60 Minutes	60 Minutes	3:00	10:00	12:00	19:00
3:30	10:30	12:30	19:30		Escape! Fire	3:30	10:30	12:30	19:30	Wheel Of Fortune			3:30	10:30	12:30	19:30
4:00	11:00	13:00	20:00		The FBI Files (TV-PG)	4:00	11:00	13:00	20:00	Today	Touched By An Angel (TV-PG)	Touched By An Angel (TV-PG)	4:00	11:00	13:00	20:00
4:30	11:30	13:30	20:30		Killing Spree	4:30	11:30	13:30	20:30		My Brother's Keeper	My Brother's Keeper	4:30	11:30	13:30	20:30
5:00	12:00	14:00	21:00	ESPN Sportscenter	ER (TV-14)	5:00	12:00	14:00	21:00		Walker, Texas Ranger (TV-PG)	The West Wing (TV-14)	5:00	12:00	14:00	21:00
5:30	12:30	14:30	21:30		Fevers Of Unknown Origin	5:30	12:30	14:30	21:30		A Woman's Pain	Five Votes Down	5:30	12:30	14:30	21:30
6:00	13:00	15:00	22:00	Headline News	Spectrum Movie	6:00	13:00	15:00	22:00	The New Adventures Of Winnie The Pooh	Pacific Report	Pacific Report	6:00	13:00	15:00	22:00
6:30	13:30	15:30	22:30	Morning Biz Report and ABC WNAM	Indictment: The McMartin Trial (TV-PG)	6:30	13:30	15:30	22:30	Disney's Aladdin (TV-Y)	<:35> Tonight Show with Jay Leno	<:35> Tonight Show with Jay Leno	6:30	13:30	15:30	22:30
7:00	14:00	16:00	23:00	Good Morning America		7:00	14:00	16:00	23:00	Scuigglevision (TV-Y)			7:00	14:00	16:00	23:00
7:30	14:30	16:30	23:30			7:30	14:30	16:30	23:30	All That (TV-Y)	<:35> Late Show with David Letterman	<:35> Late Show with David Letterman	7:30	14:30	16:30	23:30
8:00	15:00	17:00	0:00		Rugrats (TV-Y)	8:00	15:00	17:00	0:00	Jeopardy!			8:00	15:00	17:00	0:00
8:30	15:30	17:30	0:30		Aaahh!!! Real Monsters (TV-Y)	8:30	15:30	17:30	0:30	Headline News	<:35> ESPNews	<:35> ESPNews	8:30	15:30	17:30	0:30
9:00	16:00	18:00	1:00	USA Soccer (ESPN2)	The Simpsons (TV-PG)	9:00	16:00	18:00	1:00	Morning Business Report	<:05> Movies 'Til Dawn	<:05> Movies 'Til Dawn	9:00	16:00	18:00	1:00
9:30	16:30	18:30	1:30		Home Improvement (TV-PG)	9:30	16:30	18:30	1:30	<:33> CNN/SI			9:30	16:30	18:30	1:30
10:00	17:00	19:00	2:00	2002 World Cup Qualifier USA at Costa Rica	Star Trek: Deep Space Nine (TV-PG)	10:00	17:00	19:00	2:00	60 Minutes	The Verdict	The Verdict	10:00	17:00	19:00	2:00
10:30	17:30	19:30	2:30		The Emperor's New Cloak	10:30	17:30	19:30	2:30		(TV-PG)	(TV-PG)	10:30	17:30	19:30	2:30
11:00	18:00	20:00	3:00	Tour de France (ESPN)	Nova	11:00	18:00	20:00	3:00	Touched by An Angel (TV-PG)	<:10> Movies 'Til Dawn	<:10> Movies 'Til Dawn	11:00	18:00	20:00	3:00
11:30	18:30	20:30	3:30		Escape! Fire	11:30	18:30	20:30	3:30	My Brother's Keeper	The Absolute Truth (TV-PG)	The Absolute Truth (TV-PG)	11:30	18:30	20:30	3:30
12:00	19:00	21:00	4:00	SportsCenter	The FBI Files (TV-PG)	12:00	19:00	21:00	4:00	The West Wing (TV-14)			12:00	19:00	21:00	4:00
12:30	19:30	21:30	4:30		Killing Spree	12:30	19:30	21:30	4:30	Five Votes Down			12:30	19:30	21:30	4:30
13:00	20:00	22:00	5:00	Navy/Marine Corps News	ER (TV-14)	13:00	20:00	22:00	5:00	Headline News	Headline News	Headline News	13:00	20:00	22:00	5:00
13:30	20:30	22:30	5:30	Army Newswatch	Fevers Of Unknown Origin	13:30	20:30	22:30	5:30	<:33> Tonight Show with Jay Leno	ESPNews	ESPNews	13:30	20:30	22:30	5:30
14:00	21:00	23:00	6:00	Your World	Spectrum Movie	14:00	21:00	23:00	6:00		Today	Today	14:00	21:00	23:00	6:00
14:30	21:30	23:30	6:30		Indictment: The McMartin Trial (TV-PG)	14:30	21:30	23:30	6:30	<:35> Late Show with David Letterman			14:30	21:30	23:30	6:30
15:00	22:00	0:00	7:00	World View		15:00	22:00	0:00	7:00				15:00	22:00	0:00	7:00
15:30	22:30	0:30	7:30	NBC Nightly News		15:30	22:30	0:30	7:30	<:35> Showbiz Today			15:30	22:30	0:30	7:30
16:00	23:00	1:00	8:00	ABC World News Tonight	Rugrats (TV-Y)	16:00	23:00	1:00	8:00	Headline News	Headline News	Headline News	16:00	23:00	1:00	8:00
16:30	23:30	1:30	8:30	CBS Evening News	Aaahh!!! Real Monsters (TV-Y)	16:30	23:30	1:30	8:30	WNBA (ESPN)	Showbiz Today	Showbiz Today	16:30	23:30	1:30	8:30
17:00	0:00	2:00	9:00	2000 US Olympic Trials (NBC)	The Simpsons (TV-PG)	17:00	0:00	2:00	9:00	New York Liberty at Washington Mystics	Sesame Street	Sesame Street	17:00	0:00	2:00	9:00
17:30	0:30	2:30	9:30	Track and Field	Home Improvement (TV-PG)	17:30	0:30	2:30	9:30				17:30	0:30	2:30	9:30
18:00	1:00	3:00	10:00		Star Trek: Deep Space Nine (TV-PG)	18:00	1:00	3:00	10:00		Bear In the Big Blue House (TV-Y)	Bear in the Big Blue House (TV-Y)	18:00	1:00	3:00	10:00
18:30	1:30	3:30	10:30		Field Of Fire	18:30	1:30	3:30	10:30	ESPNews	Co-Ed Training	Co-Ed Training	18:30	1:30	3:30	10:30
19:00	2:00	4:00	11:00	MLB Hall of Fame (ESPN2)	Time & Again (TV-PG)	19:00	2:00	4:00	11:00	CNN/SI	Oprah Winfrey (TV-14)	Oprah Winfrey (TV-14)	19:00	2:00	4:00	11:00
19:30	2:30	4:30	11:30	Ceremonies	Celine Dion/Shania Twain	19:30	2:30	4:30	11:30		Should You Be Doing That?	Should You Be Doing That?	19:30	2:30	4:30	11:30
20:00	3:00	5:00	12:00	Sports Tonight	Intimate Portraits (TV-PG)	20:00	3:00	5:00	12:00	Headline News	NBC Nightly News	NBC Nightly News	20:00	3:00	5:00	12:00
20:30	3:30	5:30	12:30		Vanessa Williams	20:30	3:30	5:30	12:30	ABC World News Tonight	Wheel Of Fortune	Wheel Of Fortune	20:30	3:30	5:30	12:30
21:00	4:00	6:00	13:00	Larry King Live	Law & Order (TV-14)	21:00	4:00	6:00	13:00	CNN/SI	Port Charles (TV-14)	Port Charles (TV-14)	21:00	4:00	6:00	13:00
21:30	4:30	6:30	13:30		Matrimony	21:30	4:30	6:30	13:30	NBC Nightly News	<:25> Guiding Light (TV-14)	<:25> Guiding Light (TV-14)	21:30	4:30	6:30	13:30
22:00	5:00	7:00	14:00	News with Brian Williams	Spectrum Movie	22:00	5:00	7:00	14:00	Sesame Street	<:15> General Hospital (TV-14)	<:15> General Hospital (TV-14)	22:00	5:00	7:00	14:00
22:30	5:30	7:30	14:30		Rookie Of The Year (TV-PG)	22:30	5:30	7:30	14:30				22:30	5:30	7:30	14:30
23:00	6:00	8:00	15:00	The O'Reilly Factor		23:00	6:00	8:00	15:00	Bear in the Big Blue House (TV-Y)	<:05> Larry King Live	<:05> Batman Beyond (TV-Y7)	23:00	6:00	8:00	15:00
23:30	6:30	8:30	15:30			23:30	6:30	8:30	15:30	Co-Ed Training		Beakman's World (TV-Y7)	23:30	6:30	8:30	15:30

MONDAY, JULY 24, 2000

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APPENDIX E. TELEVISION WEEKLY PROGRAMMING

Television Weekly (TW) unit 30-0 is the programming that aired on network television during the 30th week calendar year 2000. Armed Forces Radio and Television Service (AFRTS) provides each TW unit with a copy (packing list in the TW unit case) for quick reference of programming provided.

TW 30-0

OFFLINE RECORDING/DUPLICATING/PACKING LIST

Item	Title	Remarks	RT
1.01	Jag		60
1.02	Judging Amy		60
2.00	National Geographic Explorer		120
3.01	Xena: Warrior Princess		60
3.02	Home Improvement		30
3.03	Wheel Of Fortune (Mon)		30
4.01	Jeopardy (Mon)		30
4.02	The Practice		60
4.03	Wheel Of Fortune (Tue)		30
5.01	Jeopardy (Tue)		30
5.02	Movie: Michael Collins (Reel 2 Of 2)		30
5.03	Wheel Of Fortune (Wed)		30
5.04	Jeopardy (Wed)		30
6.00	Movie: Michael Collins (Reel 1 Of 2)		120
7.01	Dawson's Creek		60
7.02	Ally McBeal		60
8.01	Wheel Of Fortune (Thu)		30
8.02	Jeopardy (Thu)		30
8.03	Friends		30
8.04	Steve Harvey Show		30
9.01	Fraisier		30
9.02	Spin City		30
9.03	Flex Appeal		30
9.04	Wheel Of Fortune (Fri)		30
10.01	NYPD Blue		60
10.02	Homicide: Life On The Streets		60

TW 30-0

OFFLINE RECORDING/DUPLICATING/PACKING LIST

11.01	Sister, Sister			30
11.02	Sabrina, The Teenage Witch			30
11.03	Jeopardy (Fri)			30
11.04	The Simpsons			30
12.01	Star Trek: Voyager			60
12.02	X-Files			60

APPENDIX F. DVD TECHNICAL DATA SHEET

Appendix F is the DVD technical data sheet provided on the Americ Disc, products and

services web page. It is included to provide additional information to enhance the

readers' knowledge of DVD disc makeup and storage capabilities.

DVD TECHNICAL DATA SHEET	DVD 5	DVD 9	DVD 10	DVD 18
Diameter of the disc	120 mm	120 mm	120 mm	120 mm
Thickness of the disc	1.2 mm (0.6 * 2)	1.2 mm	1.2 mm	1.2 mm
Number of sides	1	1	2	2
Number of layers	1	2	2	2
Diameter of the central hole	15 mm	15 mm	15 mm	15 mm
Minimum pit size	0.4 microns	0.4 microns	0.44 microns	0.44 microns
Track width	0.74 microns	0.74 microns	0.74 microns	0.74 microns
Wavelength of the laser diode	650 mm			
Digital lens aperture	0.6			
Maximum data read-out rate	11.08 Mb/s (one-speed player)			
Capacity	4.7 Gb	8.5 Gb	9.4 Gb	17 Gb
Storage	133 mn of video	242	266	484
Number of audio tracks	8	8	8	8
Number of subtitling tracks	32	32	32	32

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